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HIMALAYAN ECO-DEVELOPMENT PROJECT

UNIVERSITY OF KASHMIR



FIRST ANNUAL REPORT

TELBAL-DACHIGAM CATCHMENT

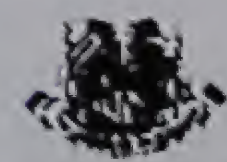
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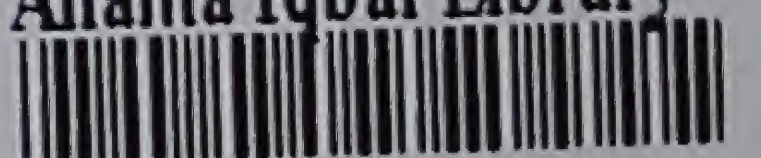
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I n t r o d u c t i o n

Under the Hill Areas Development Programme, the Planning Commission, Government of India, took a massive programme to study the ecology and ecosystems of the Himalayas. The University of Kashmir, Srinagar, was given the responsibility to investigate the man-nature interaction in the western Himalayas under the 'Western Himalaya Eco-development Project.' The University of Kashmir, under the supervision of Professor Wahid u. Malik gratefully accepted the project and started working on the Doodh-Ganga Basin. But later on the area of study was shifted to the 'Telbal-Dachigam Catchment.'

The Telbal-Dachigam Catchment, situated on the western aspect of the Mahadev Mt., on the eastern side of the Dal lake exhibits acute environmental degradation. The rivulets and streams of the catchment discharge their water into the Dal lake. Telbal-Nala which merges into the Dal is the main pollutant of this natural asset. Moreover, the Catchment is quite rich in fauna and flora. The population of the catchment has transformed the physical milieu and created a cultural landscape which is vulnerable and not

regenerative. Looking at the extent of environmental degradation and the pollution of the Dal lake the University of Kashmir selected the 'Telbal-Dachigam Catchment' as the area of study. This catchment is in the vicinity of the University Campus and easily accessible.

To explore the various aspects of ecological setting and ecosystem of the area, a team of experts from the various disciplines of biological and social sciences was selected. The major thrust of the work is on the regional and biotic structure, resource base, occupational structure, forest and animal husbandry, cropping patterns and horticulture. Attempts are also to be made to ascertain the extent of environmental degradation before an action oriented modal for the western Himalayas can be prepared.

Professor P. Kachroo and Professor V. Kaul from the Department of Botany, Professor D.N. Fotedar from the Department of Zoology, Professor M.Y. Qadri and Dr.A.M.Shah from Centre of Research for Development, Professor A.R.Matto from the Department of Commerce and Dr. Majid Husain from the Department of Geography and Regional Development are working on various aspects of the project with Professor Jagdish Shankar as the Coordinator.

The present annual report gives an idea of the work

done in the field of socio-economic structure, Agro-horticulture and forestry. Work on the other aspects, described at the outset is also under progress. On the basis of all these studies of experts of various disciplines a synthesis of the work will be made on the basis of which a strategy would be evolved for the management of the environment in the Western Himalayas.

TELBAL DACHIGAM CATCHMENT
A SOCIO-ECONOMIC PROFILE

The Telbal-Dachigam catchment, selected for study under the Himalayan-Ecodevelopment Project by the University of Kashmir has a unique geographical personality. It is situated in the vicinity of the Srinagar city, towards the east of Dal lake and sprawls over an area of 4019 hectares with a total population of 38457 according to the survey conducted in June, 1983. The Telbal-Dachigam rivulets, torrents and streams, escape into the Dal lake. Some of the feeders of Telbal-Dachigam originate as high as the glacial tract of Tarsar (3,781) which drain the western phase of the Harwan and Mahadev peaks. The landscape is undulating, characterised with alluvial fans. Natural fertility of the alluvium, the abundance of precipitation, the nature of enveloping slopes and the favourable summer temperature regimes have not only given the catchment a unifying homogeneity and a socio-economic viability at a low level of technology but have also infused into the system an internal strength which is the basis of historical continuity of the region. Nevertheless, the catchment under study has significantly been adversely affected by the over-interaction of man in the eco-system. Consequently there is ecological degradation, extreme deforestation, soil erosion, depleting

water resources which led to poor socio-economic conditions of the people.

In my report I would like to present a brief account of the socio-economic conditions prevailing in the area under study. To generate basic information and data on the socio-economic aspects of the area a field survey was conducted in the form of structured questionnaires. The information were collected in the form of village-schedule and the household schedules. The total number of villages in the catchment is 25, out of which 15 are situated in the levelled area, seven on the undulating gentle slope and only three at a higher altitude of about 2,000 metres. Information and data of all the 25 villages was collected from the secondary sources as well as the primary sources; while 10 per cent of the total household in each of the 25 villages was taken as the sample. For the purpose of sampling the random sampling was adopted, so that each item in the 'parent-population' has an equal chance of being included in any sample, making the sample unbiased, more objective and the representative of the whole body of data. The present report is thus based on 324 households.

The villages situated in the Dachigam vary in their shape, size and settlement patterns. It has been observed

that the villages situated in the levelled topography are compact to semi-compact, while those on the slopes are fragmented and dispersed.... villages are accessible by the metalled road while the remaining have only jeepable and unmetalled roads. There are 18 primary schools, 15 middle schools, 4 High schools and one Intermediate College. So far as the other social amenities are concerned there are six dispensaries, two health centres, three veterinary hospitals, four post and telegraph offices, five cooperative societies, four banks and eleven craft centres.

The total population ascertained after conducting the field work in June 1983 was 38,457 as against 31,316 reported by the 1981 census. Out of which 21,530 were males and 16,927 females giving the overall sex-ratio of the region as 786 females to per thousand of males. This figure is fairly below the state average of 899 and the national average of 921.

So far as the rate of literacy is concerned only 24.94 per cent of the total population are literates, and the share of the females in the literates and educated is only about 28 per cent. The low literacy and education level among the females can be attributed to the negative social attitudes, orthodoxy and inadequacy of girls schools

in the traditional bound society in which females generally remain confined to the four walls of their houses. The total work force is 11,355, out of which about 70 per cent are males and 30 per cent females. Thus 29.5 per cent work force is supporting to 70.5 juveniles and saviles and thus the work force owe heavy socio-economic responsibility.

The population growth rate, computed on 1971 as the base year is 3.71 per cent which is fairly high to the State average of 2.89 per cent. From the high birth-rate in the Dachigam area it may be infered that the family welfare programme is still to make any impact in the area.

Agriculture is the main-stay of the people which engages directly and indirectly over 75 per cent of the total population. The remaining 25 per cent is dependent on cottage industries, handicrafts - especially in needle work and ancillary activities.

Agricultural calender in the catchment commences in the month of April after the advent of Spring. Paddy and maize are the dominant Kharif crops generally sown in the month of May and harvested in September and October. Oil-seeds like mustard and rape-seeds are the important Rabi crops which are sown in the months of November and harvested in April or May. Moreover, some vegetables are also

grown for the domestic consumption and for the neighbouring markets of the Srinagar city. Owing to severe winters and adverse temperature conditions, high yielding varieties of wheat have not been diffused. A peculiar, phenomena of the agricultural landscape is the orchards. There are apple orchards in the area which fetch handsome amount to the owners. Plantation of apple and other fruit trees is normally done in the months of March and April, fruits from the orchards are available from June to November.

It has been observed while conducting the field work that the frontiers of agricultural lands have been pushed into the grazing and vulnerable areas. Moreover, some of the highly fertile tracts of land in the vicinity of village settlements have been brought under houses. The land man ratio is 0.083 acres in the area and day by day it is on the decreasing side. In the absence of alternate occupation the arable land is supporting high population.

So far as the general land use of the 25 villages of the catchment is concerned it is, the total reporting area is 6293.71 acres out of which only 43.30 acres or 0.68 per cent is under forest. From this figure it may be deduced that in each of the 25 villages irrespective of their topography and nature of slopes forests have been removed. The high rate of soil-erosion and consequent upon the

silting of the Dal lake are some of the serious repercussions of forest depletion. About 30 per cent of the reporting area is not available for cultivation, which is either barren (17.55%) or under settlements, roads and ponds etc. About one per cent of the area is under miscellaneous trees and nearly 10 per cent is under pastures. Thus the land available for cultivation is only 2802.16 acres or 44.52 per cent of the total area. The intensity of agriculture is only 114 per cent as double cropping was done on 406 acres only. In fact the winter low temperature do not permit a second crop and the oil-seeds sown, generally result into poor outturns.

The cultivators of the area under review on the basis of their empirical experience and mostly continuing the tradition cropping cycle. In the cropping structure, paddy is the leading crop, occupying about 2800 acres or 87.3 per cent of the gross-cropped area, and 404.48 acres (12.6%) of the total cropped area is under oil-seeds. Maize is the only other cereal crop which is insignificant as it occupies only 0.1 per cent of the gross-cropped land. It is interesting to note that high yielding varieties have been adopted by most of the farmers, occupying almost the entire paddy area, nevertheless, their performance is not at the desired level. It may be because of the inadequacy of inputs and other socio-economic conditions.

Horticulture is another peculiar characteristic of the agricultural landscape of the Telbal-Dachigam basin. Apples and cherry are the major fruits, while walnut and almond are the nuts planted by the growers. The total area under orchards in the year 1982-83 was 923.81 acres, out of which about 57 per cent was devoted to apple, about 8 per cent to cherry and about 25 per cent to walnut, while almond occupied about 10 per cent of the total orchards area.

Orchards are contributing significantly to the income of the farmers. The total income from orchards, as ascertained by conducting survey in the form of village schedule, was 1.42 crores. Out of this the share of apple was 99.7 lakhs or about 70 per cent. Cherry contributed 2.9 lakhs (2.03%) while the share of walnut and almonds was 17.70 (12.43%) and 22.11 lakhs (15.53%), respectively.

The average productivity of cereal and non-cereal crops has also been worked out. The average yield of paddy was 19.20 quintals which is slightly below to Punjab and Haryana where it is about 22 quintals per acre. On the average oil-seeds (mustard) production per acre is about 9.6 quintals which gives about Rs 3,200 to the grower as a gross return. Maize is an insignificant crop grown in the elevated well drained tracts. Its average yield is about

12 quintals per acre. The yield rates of apple, walnut, almond and cherry have also been worked out. The production of apple, cherry, walnut, almond per acre was 18,938 kgs, 2,846 kgs, 1,558 kgs and 1,179 kgs, respectively. Within the area under survey, efficient marketing agencies are not available and therefore all the horticulture produce is marketed through private contractors.

So far as the general provisions and ancillary services are concerned, there are 13 clothing-shops, 14 shops of chemists, 20 general provision shops, 24 tailoring shops, 22 flour-mills/rice mills/oil mills/ and 17 saw factories.

In the area there is one fruit-processing factory in which apple-jam is prepared. One Fisheries Research Laboratory has been established in the area, and the Burzhama, archaeological site (the place of Neolithic pit-dwellers) is a place which helps in understanding the pre-historic culture and civilization of the area.

The articles of consumption which are not locally available are generally purchased either from the Hazratbal market or the Srinagar city. From these marketing centres, food items, pulses, household goods, clothes and furniture are purchased. The distance of Hazratbal and Srinagar city is about 10 and 25 kms respectively from the central place of the Dachigam inhabited area.

As stated at the outset there is heavy pressure of population on agricultural land, consequently about 40 per cent of the total work force visit the neighbouring urban centres in search of jobs.

The common disease recorded in the area are dyspepsia, ascariasis, U.T.I., gastro-enteritis, stomach trouble, skin-disease, cholera, gastric trouble, acidity, Kangri cancer and hypertension. The process of development in the area can be generated as all the twenty five villages are electrified and there is easy accessibility to the capital of the State.

The general socio-economic structure in brief has been described in the foregoing paragraphs. In order to have an indepth study of the Telbal-Dachigam area, a household survey in all the 25 villages was conducted in June 1983. Out of the 'universe' 10 per cent households were selected adopting the random sampling technique. The main findings of the household survey have been analysed in the following lines.

Demographic Structure:

The total population of the sampled households are worked out by the investigators was 2,514, giving an average size of household of 7.75 persons. Thus the average size of

families in Dachigam basin is slightly over to the State level (7.04). The average density of population per sq.km. is 508 persons. So far as the sex ratio is concerned there are 903 females per thousand males which is slightly over the State level (899). It is interesting to note that the sex ratio in the infancy group is 979 females per thousand males but in the elder age group it declines to 850 females per thousand of males. From these facts it can be deduced that the mortality rate among the females in the Dachigam region is higher to that of males.

From the marital point of view only 40 per cent of the total population is married and the remaining 60 per cent is either in the infancy age or unmarried. In the selected sample households 75 per cent are illiterate and 25 per cent educated. Unfortunately, the proportion of females literates is significantly low being only 23 per cent. Fifty four per cent of the literate educated got their education only upto the primary level, 20 per cent upto the secondary level 18 per cent achieved high school education and only 7 per cent reached upto University. The vocationally and professionally trained population constitutes only 0.6 per cent of the total educated population. The literacy and education of the population reveals that people are not very much responsive in sending their children to schools. It may be

because education is an expensive affair for them or they are desirous to get immediate economic returns from their children. Moreover, educational facilities beyond the primary level is not available in all the component villages. The economic backwardness and orthodox nature of the society may be said as the responsible factors for illiteracy in the region.

The work force of the sampled households has been calculated which reveals that only 25 per cent of the total population is active work force, supporting to 75 per cent of the dependents. The dependency ratio is nearly 1:3. From this analysis it may be concluded that in the Dachigam Telbal area, the opportunities of employment are inadequate, as a result of which the dependency ratio is very high. A peculiar feature of the Dachigam population is that about 98 per cent of the total sampled household population is muslim and only 2 per cent non-muslims.

Economic Structure:

The Telbal-Dachigam area, as stated earlier, is basically agrarian and most of the work force is directly or indirectly engaged in the exploitation of soil, forest and fisheries. Apart from these primary activities about 20 per cent of the total work force is earning their livli-

hood from cottage industries - especially from needlework, pottery-making. About 5 per cent of the work force is dependent on transport and shop-keeping.

Cropping Patterns:

Out of 247.87 acres area of the sampled households 14.95 acres i.e. 6.03 per cent is put to non-agricultural uses and 232.92 acres (93.97%) is devoted to crops. In the selection of crops, the empirical experience of the farmers, the convenience of the family labour, availability of inputs and irrigation facilities are the major determinants and therefore, a uniform cropping pattern cannot be suggested.

Amongst the physical factors the low temperature restrict the multiple cropping. Consequently, the intensity of agriculture is only 120 per cent as against 136 per cent for the State as a whole.

It has been observed from the field study that on one kanal of land under horticulture, the gross returns in money terms, are Rs 2,400 while the gross returns from paddy and oil-seeds together comprise just Rs 736 per kanals which is approximately one-third of the returns from horticulture. It implies that if the cropping patterns are transformed from paddy/oil seeds to horticultural activities, the

farmers may get better agricultural returns. This statement is supplemented by the fact that among sampled households only 29.11 acres of land is under horticulture, generating gross of the tune of Rs 6,26,120. While agriculture which is spread over 204.81 acres of land generate gross returns estimated at Rs 97,526. The reasons can be numerous. First, the characteristics of soil may be conducive to horticultural operations; second, it is in the vicinity of Srinagar, capital city, it has better accessibility to the insecticides and pesticides distribution centres, further it has better transport facilities available.

Land Tenancy:

Out of the 244.01 acres of the total owned area among the sampled households only 1.00 acre is leased out and 4.86 acres is leased in. Thus this given area under possession, of 247.87 acres, is spread over 506 fragmented fields; thereby giving an average of 0.47 acres area (3.796 kanals) to each fragment. Belief is that this fragmentation is the tough obstacle in introducing labour augmenting technology.

Inputs:

Diffusion of new agriculture has taken place in the area, which can be appreciated from the fact that almost in all the sampled households High Yielding Varieties of rice

have been adopted. Irrigation by canals is also available but the required complementary inputs like fertilizers, insecticides, pesticides, tools and implements are not adequately applied. The inputs survey conducted reveals that 96 per cent of the farmers use bullocks as the draught animals, and the remaining 4 per cent plough their fields with the help of tractors. About two-third of the farmers are using chemical fertilizers but the quantity applied is not at the desired level. The application of insecticides and pesticides is practised only by 8 per cent of the farmers. The High Yielding Varieties, being highly sensitive in the absence of these inputs are adversely affected.

Production:

The average yield of any areal unit is the function of physico-socio-economic factors. The low lying and levelled parts of the catchment, especially the land in the vicinity of Dal lake is highly productive, while on the undulating, over-drained fields it is significantly low. The average yield per hectare varies between 600 to 900 kg. per acre; while the average yield of oil-seeds (mustard) is about 400 kg. per acre. Returns from maize are the least remunerative, being only about 700 kg. per acre. Maize is a characteristic feature of the Gujars who are in the

process of sedentrization the higher altitudes (2000 to 2500 m). The average production of fruits and vegetables are given in appendix.

Livestock:

Cow, goat and sheep are the major livestock of the region. Out of the total livestock (708), cow constitutes 54 per cent, bullocks 23.45 per cent, goat and sheep 6 per cent. The remaining are horses and others. The indigenous breeds are however, dominant which constitute about 92 per cent of the total livestock. The major prevalent disease are mouth and feet disease in the cattle, goat and sheep. The average monthly requirement of fodder and feed is 700 and 33 kgs. which is locally met and the straw of rice is used in winters as the main fodder. The solid feed is purchased from the local shops or from Srinagar city. The monthly expenditure on fodder and feed for the livestock among the sampled household is Rs 155917. The total returns in money terms (milk and wool)** have been estimated to Rs 82090. The net returns have been estimated to the tune of Rs 73827 per month. This may be so because the returns from the bullock labour, meat, eggs have not been calculated* and had their

** Milk per kg. has been valued at Rs 3 and wool per kg. at Rs 20 as the prevalent market rate in the said catchment.

* The information on the items like meat, eggs has not been given by the respondents, though that had been incorporated within schedule.

value been worked out, the net returns from livestock wool have not been negative.

Energy:

The energy requirements have been given under three heads namely Cooking, Heating and Kangri. They reveal that only two purposes operate, namely, Cooking and Kangri. It is so because Kangri is also used for the purpose of heating because most people cannot afford the Bokharries. In the said catchment two types of fuels are used for cooking purposes, namely, firewood and cowdung.

The total quantity of firewood consumed by the sampled households has been worked out to be 83167 kgs. per month out of which 40597 kgs. are purchased and 42570 kgs. owned. In other words, 48.81 per cent of firewood is purchased and 51.19 per cent owned. Thus the per capita per month consumption of firewood among the sampled households is 33.08 kgs. In money terms the per capita has been worked out at Rs 16.66. Out of the total expenditure of Rs 41883.50, 48.46 per cent has to be paid and 51.54 per cent owned. This indicates that the per capita per month fuel expenditure to be paid Rs 8.07, however.

Similarly the total quantity of cowdung consumed by

the sampled households has been worked out to be 28160 kgs. per month out of which 1472.5 kgs. are purchased and 26687.5 kgs. owned. This in other words reveals that 5.23 per cent of cowdung is purchased and 94.77 per cent owned. These figures indicate that per capita per month consumption of cowdung is 11.20 kgs. In money terms, the per capita per month expenditure on cowdung among the sampled households has been worked out to be Rs 166.93. Out of the total expenditure of Rs 419652.21 made by 324 household surveyed, 0.087 per cent is paid for and 99.91 per cent owned. Thus in aggregate, (including firewood and cowdung) the per capita per month consumption of energy used for cooking purposes is 44.28 kgs. This shows that per day per capita energy requirement for cooking purpose is 1.48 kgs. among sampled households.

The monthly consumption of soft coal (used for heating purpose in Kangri) is 120869 kgs. out of which 98800 kgs. of the value of Rs 98800 purchased and 22069 kgs. of the value of Rs 22069 owned. This indicates that 81.74 per cent of soft coal is purchased and 18.26 per cent owned. The per capita per month consumption of soft coal among the sampled households has been worked out as 48.08 kgs., which in monetary terms is equal to Rs 48.08. The average monthly household consumption of soft coal has been worked out at

373.05 kgs. This indicates that the per capita per day requirements of soft coal among the sampled household is 1.60 kgs. Converting cowdung and soft coal into one standard, km, that is, in terms of firewood, (2 kgs of coal = 1 kg of firewood and 3 kgs of cowdung = 1 kg of firewood) the per capita per day requirement of energy in the sampled households is 2.03 kgs. which in money terms is valued at Rs 3.21 under the present conditions.

Agricultural Waste:

Agricultural waste plays a significant role in the present economy. Agricultural waste is a multipurpose unit having numerous functions in the village economy. It not only fulfills the partial requirements of the fodder for livestock but is also used for construction of roofs of the houses. Cowdung is used not only as fertilizer but also as principal source of energy required in the household.

Bearing its importance, certain questions have been administered to the respondents and the information collected therefrom reveals that out of the total quantity of agricultural waste amounting to 625474 kgs., 596472 kgs. are contributed by grass, 28157 kgs. by cowdung and a small proportion (845 kgs) by other type (including vegetable waste, etc.) In other words 95.36 per cent of the agricultural waste is contributed by grass, 4.50 per cent by

cowdung and in money terms amounts to Rs 137855.4 out of which Rs 126496.00 are from grass, Rs 7109.4 from cowdung and Rs 4250.00 from other sources. Out of the 324 sampled households agricultural waste is available only in 189 households. Of these 189 households the agricultural waste is used up for their needs and only about 1 per cent of them sell it.

Infrastructure:

The 324 sampled households have 1389 rooms in use giving thereby 4 rooms per household on an average. Out of the total sampled households 46.91 per cent houses are pucca and the remaining 52.09 per cent are Kuchha mud houses. Regarding sanitation, 12.96 per cent are having satisfactory pucca drainage 29.01 per cent normal sanitation and the remaining 58.03 per cent unsatisfactory or no sanitation. Out of the total households surveyed 80.56 per cent have open toilets in the fields, 2.77 per cent community toilets and 16.67 per cent have separate toilet system. Regarding sources of drinking water, 92.59 per cent have tap water, 4.32 per cent use canal water and 3.09 per cent spring water. 43.53 per cent sampled households are linked with metaled roads and 56.48 per cent having not satisfactory road facilities, 80 per cent of the villages have satisfactory transport facilities and 20 per cent have no such facilities available. All the villges are electrified and all the

sampled households use Allpathic system of medicine.

These observations lead us to deduce that most of the infra-structural facilities like sanitation, toilets, roads, etc. are not available to the majority of the sampled households. Low availability of such amenities, which has its adverse effect on one's health, leads to low capacity to work, low incomes, low nutrition and ill health. If this cycle is to be broken, the above infra-structural facilities need to be augmented as their absence is the root cause of such poverty and poor health.

The above discussion gives a general idea of the cultural landscape of the Telbal-Dachigam region. In order to understand the man-nature interaction in the catchment under review, a more systematic analysis will be made when the data is computed with the help of sophisticated statistical tools. After ascertaining the real nature of the man-nature interaction a modal for the area under study will be prepared which can be applied with modifications in the other parts of the Western Himalayas. This anthropocentric model will help in the environmental planning of the Western Himalayas.

VEGETATIONAL STUDIES:

Though the Eco-development Project was started in last October 1982 the actual field work could not be started till April 1983 for inclement weather conditions, inavailability of transport and other reasons. The Dachigam-Telbal catchment being very vast, only a segment of it has been selected for both extensive and intensive studies in regard to phyto-sociology, productivity, phytomars and energy transfers, tree architecture vis-a-vis runoff and erosion and biogeochemical cycling etc. This segment of the catchment represented by Dachigam sanctuary, a national park, rectangular in shape and encompassing an area of about 141 sq. kms. with its length and breadth approximating to 22.5 and 8 km. respectively. The valley is enclosed by mountains constituting a part of Zaskar range. Two steep ridges, one arising from Harwan reservoir with peaks between 2,600 to 3,000 m. above sea level and another east of Theed rising to 4,000 m. above sea level, form the natural boundry of the area. The folds of these ranges are thrown into a number of undulations enclosing narrow gullies locally called 'Nars'. The topography is slopy and mountainous and provides excellent sites for the study with respect to aspect, altitude and slope, etc. The sanctuary forms almost half of the catchment zone of Dal lake, the great tourist attraction in Kashmir.

Description of study sites: The sanctuary is apparently divided into two sectors i.e. (i) the lower Dachigam and (ii) the upper Dachigam, with the former in the west comprising approximately one third of the total area and supporting both natural and artificially raised vegetation, and the latter in the east extending over higher reaches.

Vegetational characteristics:

Vegetational studies by quadrats and transects have been carried out in almost the whole of the sanctuary through regular field trips. The data collected has been computed and the various plant associations delineated. IVI of the various plant species is presented in tabular form. The vegetation of the whole area is described under two headings, i.e. (i) vegetation of Dachigam mountain slopes and (ii) vegetation of Dachigam ravine.

Dachigam Mountain Slopes:

The following district forest communities and associations are recognized:

I. Pinus griffithii - Rosa brunonii association.

Species present (Altitude 1700-1800 m. Aspect north-east)

<u>Pinus griffithii</u>	140.4
<u>Rosa brunonii</u>	17.2
<u>Parroticopsis Jaequemontiana</u>	16.4
<u>Rosa webbiana</u>	15.6

<u>Rhus antennifer</u>	14.2
<u>Indigofera heterantha</u>	12.3
<u>Lonicera quinquetocularis</u>	10.2
<u>Jasminum humile</u>	8.4
<u>Viburnum Cotinifolium</u>	7.8
<u>Rubus Ulmifolius</u>	7.2
<u>Enonymus fimbriatum</u>	5.9
<u>Berberis Pseudoumbellata</u>	5.8
<u>Isden plectroanthoides</u>	5.0
<u>Rosa macrophylla</u>	4.2
<u>Rubus Succedanea</u>	3.8
<u>Prunus Cerasifera</u>	3.8
<u>Hedesa nepalensis</u>	3.7
<u>Berberis lycium</u>	3.5
<u>Daphne Olioides</u>	2.8
<u>Crataegus monogyne</u>	2.2

The association occurs in isolated grooves on the slopes overlying the ravines between Harwan reservoir and Drapahama. These grooves remain shaded throughout the year and have shad poor stratification.

II. Pinus griffithii - Viburnum Cotinifolium association:

Aspect Northern. Altitude: 2300 m.

Species IVI

<u>Pinus griffithii</u>	156.2
<u>Viburnum Cotinifolium</u>	20.6
<u>Staphyles emodi</u>	18.4
<u>Rubus pungens</u>	17.2
<u>Berberis pachgacantha</u>	15.8
<u>Perrotiopsis Jacquemontiana</u>	14.8
<u>Rosa mecrophytla</u>	10.2
<u>Indigojera hebepetala</u>	9.4

<u>Isodon plectranthoides</u>	9.4
<u>Jasminium humile</u>	9.3
<u>Berberis pseudoumbellata</u>	8.7
<u>Lonicera quinqueularis</u>	7.8
<u>Spiraea canescens</u>	6.4
<u>Sinilax vaginata</u>	6.2
<u>Corylus colurna</u>	6.0
<u>Cotoneaster rosea</u>	4.2
<u>Acer cappadocicum</u>	2.1
<u>Crataegus monogyna</u>	

Paratiopsis Jacquementiana is dominant in the outer mountain ranges and covers more than 60% of the northeast to northwest slopes of the outer northern range extending between 1700 - 2450 m. in the form of pure communities. Analysis of 20 stands of Paratiopsis scrub distributed in the reserve revealed the following composition.

Species present	IVI (Average)
<u>Parapiopsis Jacqmontiana</u>	130.4
<u>Rosa Webbiana</u>	28.4
<u>Indigofera heterantha</u>	26.2
<u>Isodon Plectoranthoides</u>	20.2
<u>Berberis lycium</u>	16.8
<u>Jasmanium humile</u>	14.2
<u>Lonicera quinquelocularis</u>	12.6
<u>Viburnum cotinifolium</u>	9.2
<u>Rosa brunonii</u>	8.2
<u>Rosa macrophylla</u>	11.4
<u>Pinus griffithii</u>	8.2
<u>Berberis pachyacantha</u>	7.5
<u>Prunus armeniaca</u>	7.0

<u>Cotoneaster recimiflora</u>	6.4
<u>Spiraea caneseus</u>	6.1
<u>Padus Cornuta</u>	4.1
<u>Clematis grata</u>	4.0

Corylus-padas Association:

This association has been observed at lower levels and is very poorly represented along the mountain slopes between 2300 -2900 m. in the outer ranges in the form of small groves.

Species present	IVI
<u>Corylus colurna</u>	82.4
<u>Padus cornula</u>	47.3
<u>Parrotiopsis Jacquemontiana</u>	27.4
<u>Ulmus Wallichiana</u>	25.3
<u>Staphylea amodi</u>	22.6
<u>Berberis Pachyacantha</u>	20.1
<u>Pinus griffithii</u>	15.3
<u>Rubus Pungens</u>	14.6
<u>Rosa maerophylla</u>	14.2
<u>Acer Cappadocicum</u>	14.2
<u>Viburnum grandiflorum</u>	6.7
<u>Indigofera heteranllia</u>	5.4
<u>Rosa Webbiana</u>	5.3
<u>Indigofera hebepetala</u>	4.9
<u>Smilax vaginata</u>	2.8
<u>Cotoneaster rosea</u>	2.4
<u>Spiraea Canescens</u>	2.4

Abies Findrow Picea Simithiana association.

This association is distributed between 2300-3200 m.

on inner ranges. At lower level the association passes into blue pine while at the upper reaches it is replaced by birch.

Plant species	IVI (Average)
<u>Abies pindrow</u>	170.2
<u>Picea smithiana</u>	165.4
<u>Taxus Wallichiana</u>	78.3
<u>Pinus griffithii</u>	101.2
<u>Acer Caesium</u>	64.3
<u>Padus Corruta</u>	44.5
<u>Staphyles emodi</u>	36.2
<u>Corylus colurna</u>	32.4
<u>Salix Wallichiana</u>	28.4
<u>Aescinlus indica</u>	26.0
<u>Parrotiopsis Jacquemontiana</u>	20.7
<u>Berberis sps.</u>	2.1

Abies pindrow - Betula Utilis association:

Plant species	IVI	Altitude - 3100 m
<u>Abies Pindrow</u>	172.2	
<u>Betula utilis</u>	104.4	
<u>Rhododendron Compiculatum</u>	76.2	
<u>Syringia emodi</u>	32.2	
<u>Viburnum grandiflorum</u>	24.4	
<u>Salix Wallichiana</u>	24.2	
<u>Lonicera Purpurascens</u>	12.3	

The herbaceous cover in this association has several taller species like Aster thomsonii, Saussurea Candolleana, Cimicifuga foetida, Aquilegia fragrans, Valeriana hardwickii, fragaria vesca, Aster diplostaphioides, Sieversia elata and Anemone obtusiloba etc.

Birch Forest:

Birch forest occurs between 2900 - 3750 m. in the fullies and along the northerly slopes. At lower levels it extends into Silver fir where both the alpine and lower level species occur in association. Higher up it forms pure stands. Few woody speus are associated with birch at lower levels.

i) Woody species:

Betula utilis, Rhododendrm sp., Syringer emodi,
Lonicesa dis color , L. Furpurascens, Rhododendron anthopogom
Juniperus recurva, Ganltheria trichophylla,

Herbaceous species:

Sieversia elata, Sibbaldia cuneata, Anemone obtusiloha,
Iris hookeriana, Sassurea atkinsorii, Fragasia vesca, etc.

Rhododendron Campanulatum - Syringer emodi association:

This association is locally common along mountain streams and on glacial deposits. The plant species with descending IVI values are listed below:

Rhododendron companulatum, Syringa emodi, Lonicera
purpurascens, Rosa macrophylla var. minor, Salvia hians,
Phlonius bractersa, Saussurea Candolleana, Aster thomsonii,
Nepeta govaniana, Aquilegia fragrans, etc.

Rosa Webbiana - Indigofera heterantha association:

This association usually occurs on slopes of southern range facing the ravine in the form of narrow strip and forms the ecotone between various plant communities. The general vegetational analysis of this association is given below:

Plant species	IV1	Data based on a synthesis of studies made on 15 stands ranging from 1700 to 2400 m altitude.
<u>Rosa Webbiana</u>	104.5	
<u>Indigofera heterantha</u>	85.5	
<u>Berberis lycium</u>	52.0	
<u>Rosa brunonii</u>	42.0	
<u>Lonicera quinqueloculasis</u>	30.3	
<u>Coloneaster racemiflora</u>	24.2	
<u>Isodon Plectranthoides</u>	21.2	
<u>Rubus Ulmijcluis</u>	21.0	
<u>Jasminium humile</u>	15.3	
<u>Farratiopsis Jacquemontiana</u>	9.4	
<u>Prunus cerasifera</u>	8.2	
<u>Bubus niveus</u>	7.2	
<u>Clematis grata</u>	4.3	
<u>Ziziyphus jujuba</u>	4.2	
<u>Prunus Prostrata</u>	3.7	
<u>Eucnymin hamiltonianus</u>	3.6	
<u>E. fimbrialus</u>	3.5	

Scrub Savana:

More steeper slopes are dominated by tufted grasses - especially the slopes facing southeast and south-southwest in the outer ranges. Vegetational composition based on a study of 19 stands between 1700 - 2400 m. altitude is given

below:

Plant species	IVI (Average)
<u>Chrysopogon echinulatus</u>	93.2
<u>Jhemeda anthera</u>	70.3
<u>Artemisia vestita</u>	40.4
<u>Origanum normale</u>	37.2
<u>Earex setigera</u>	10.5
<u>Saussulea albesons</u>	9.8
<u>Koeleria cristata</u>	9.0
<u>Euphorbia pilosa</u>	6.0
<u>Lychnis Coronaria</u>	5.3
<u>Artemiris nilgirica</u>	5.2
<u>Stipa sibirica</u>	4.1
<u>Artemisia puviflora</u>	3.2
<u>Heracleam Candicans</u>	3.2
<u>Baplevrum falccum</u>	3.1
<u>Nepeta Linearis</u>	3.1
<u>Onosma hispidum</u>	2.9
<u>Galium Verum</u>	2.3
<u>Lotus Corniculatus</u>	1.9

Woody associations in srub savanna are those of Berberis lycium, Rosa Webbiana, Lonicera sps., Rosa brumonii, Isodin Plectranthoides, Paratiopsis Jacqmontiana, crctonaster racemiflora, Eunnymus fimbriatus, clematis sps etc. with their IVI values ranging from 20 - 5 in a descending order.

Sambucus Wightiana community:

S. Wightiana forms belts of communities along the Reserve. It is associated with Stipa sibirica, origanum

normak and Artemisia vestita at lower levels and A. nilgirica at upper levels.

Themeda anathesa-Dactyctius glomerata association:

This grassland association is common on all the mountains slopes between 1900 - 2000 m. The associates are Artemeria vestita, medicagolupilina, Bromus mollis and Crepis sps. etc.

2. Dachigam Ravine:

The ravine is essentially flat merging gradually with the northern range on one side and a bit abruptly with the southern range on the other sides. An artificial barrier separates it from the rest of the catchment area. It harbours an admixture of introduced species which are now almost naturalized. Originally the ravine represented an area occupied by ten villages which were shifted by Maharaja to some other places in 1910, and the area is preserved and protected from human disturbances since the vegetation comprises mostly the introduced elements with a sprinkling of natural types that have apparently shifted from slopes to ravine over the years. The various plant communities present are described below.

Robinia pseudoacacia community:

The stands of this community are distributed especially along road sides. It propagates by root suckers and in a

short time invades the forest openings, preventing the colonization by other species. The common associates are given below:

Plant species	IVI (Average)
<u>Robinia pseudoaccia</u>	208.4
<u>Celtis Cavcasica</u>	40.2
<u>Rosa brunonii</u>	16.4
<u>Prunus cerasifera</u>	15.2
<u>Indigofera heterantha</u>	9.2
<u>Lonicera quinquelowlaris</u>	9.0
<u>Rosa webbiana</u>	5.8
<u>Rubus antennifera</u>	3.7
<u>Rubus ulmifolius</u>	3.5
<u>Berberis lycium</u>	3.2

The Robinia pseudoaccia community reflects some interesting features i.e., (i) it invades the ground very rapidly, (ii) supresses the growth of other species mainly due to vigorous reproduction/propagation as compared to other scrub-savannali associations. The species can be best exploited for the conservation of soil. The productivity coupled with the invading capacity of this community along with that of Paratoopris - Jacqmantiana community vis-a-vis soil development and soil conservation are being looked into.

Salix alba community:

This is a man made community represented only by male plants which evidently are unable to propagate to form

natural communities. This community is present along Harwan reservoir. The shrubs such as Rosa, Rubus etc. are occasionally seen to grow alongwith. The herbaceous cover is mainly comprised of Phalaris arundinacea, Polygonum nepalense, Prunella sps., Potentilla neptans, and Geranium sps. etc.

Morus alba community:

Plant species		IVI	
<u>Morus alba</u>	217.0	<u>Rosa webbiana</u>	4.9
<u>Rhus Succedanea</u>	15.4	<u>Prunus cerasifera</u>	5.3
<u>Celtis caucasica</u>	10.2	<u>Crataegus monogyna</u>	4.1
<u>Rubus antennifer</u>	7.2	<u>Berberis lycium</u>	3.1
<u>Vitis Vinefera</u>	6.9	<u>Hedesa nepalensis</u>	2.3
<u>Lonicera</u> sps	4.9		

This community occurs in close stands in Dachigam ravine regenerating mainly by seeds. The ground cover consists of viola odorata, Tulipa clustiana, Colchicum luteum and Hemerocallis fulva etc.

Rosa brunonii - Berberis lycium community:

Species present		IVI	
<u>Rosa brunonii</u>	101.4	<u>Isodon Plectranthoides</u>	14.9
<u>R. Webbiana</u>	30.2	<u>Morus alba</u>	13.7
<u>Indigofera heterantha</u>	30.0	<u>Jasminum humile</u>	4.6
<u>Berberis lycium</u>	85.4	<u>Prunus armeniaca</u>	6.4
<u>Rubus antennifer</u>	20.1	<u>Rubus ulmifolius</u>	6.0
<u>Fraxinus antennifer</u>	18.4	<u>Celtis caucasica</u>	3.4

<u>Robinia pseudoaccacia</u>	3.7
<u>Viburnum Cotinifolium</u>	4.0
<u>Ulmus villosa</u>	4.0
<u>Rhus succedanea</u>	4.3

These shrubs grow intermixed with a gregarious growth tufted grasses like Themeda anthera, Chrysopogon echinulatus, Agropyron semicostatus, stipasibirica and while herbs like Artemisia vestita, Origanum normak, Agrimonia pilosa, Trifolium pratense are common in the openings. The shaded floor characteristically supports shade loving species like oxalis corniculatus, Fragaria vesca, Ranunculus distans, Galium sp., Potentilla sp. and Clinopodium sp.

Scrub Savana: Herbaceous communities of tufted grasses i.e. Chrysopogon echinulatus, Themeder anthera, Bothriochloa pertusa and Stipa sibirica occur in openings in outer regions near the reservoir besides along the foothills of the northern range.

Plant species	IVI (Average)
<u>Chrysopogon echinulatus</u>	60.9
<u>Themeda anthera</u>	54.7
<u>Artemisia Vestita</u>	40.4
<u>Origanum normak</u>	30.2
<u>Bothnochlow pertusa</u>	25.2
<u>Plantago lanceolata</u>	24.1
<u>Cynodon dactylon</u>	20.0
<u>Medicago lupulina</u>	15.4

<u>Stipa sibirica</u>	11.2
<u>Lychnis Coronaria</u>	8.6
<u>Nepeta laevigata</u>	7.3
<u>Agrimonia pilosa</u>	4.9
<u>Cuscuta brevistyla</u>	4.2
<u>Artemisia parviflora</u>	3.7
<u>Agropyron semicastatum</u>	3.6
<u>Trifolium sps</u>	4.0
<u>Cichorium intybus</u>	3.0

Poa stewartiana - Stipa sibirica association:

Plant species	IVI
<u>Stipa sibirica</u>	40.5
<u>Poa Stewartena</u>	60.4
<u>Carex sps</u>	46.4
<u>Fragaria sps.</u>	10.6
<u>Artemisia vestita</u>	8.1
<u>Themeda anthera</u>	6.7
<u>Bergenia Ciliata</u>	6.5
<u>Saussurea albescens</u>	4.2
<u>Lychnis Coronaria</u>	3.7
<u>Valenana stracheyi</u>	3.5
<u>Artemisia indica</u>	3.5
<u>A. nilginica</u>	2.1
<u>Asparagus filicinus</u>	2.7

Characteristic of Harwan mountain ranges. Based on data from 6 stands taken in August 1983.

Chinar stand (platinus orientalis): A pure stand of chinar occurs in the Numbal beat with a poor underwood stratifi-

cation. The ground cover is composed of Alliaria petiolata, viola odorata, colchicum sp and tulipa sps etc. However, isolated trees comprising Juglans regia, Rubus niveus, salix sp and Morus alba are also occasionally met with.

Quercus robur stand: Quercus rober is present in the form of patches near sheep bleeding huts and below Drapahama vip hut (IVI 170) intermixed with various associates such as Rhus sps (IVI 43.4), Robinia sp (IVI 40.5) Rubus sps (IVI 30.5), Prunus sps (30.2) and Berberis (IVI 20.4). The cover is almost 90%. The undershrubs are scanty and herbaceous ground flors is almost absent. During April Colchicum and Tulipa were seen growing . The studies on soil profile development under varying vegetal cover, accumulation and decomposition of organic matter, biogeochemical cycling, tree architecture and LAI, biomars production, tropho dynamics and energy fixation at various levels and energy transfers etc. are in progress. Besides a nuerowatershed has been taken up for intensive studies on the impact of vegetal cover on run-off, water absorption and retentivity of soil and soil erosion in collaboration with the Directorate of Soil Conservation of the State Government.

Mountain stream ecology:

Physical, chemical and biological characteristics

of a few mountain streams through the evaluation of the parameters like dissolved oxygen, pH, conductivity, total and available phosphorous, calcium and magnesium, chloride, nitrate and nitrite after the methods given by Mackereth (1969) and APHA (1971) in water, and the plantation density under varying habitat and season with a bias to the impact of cultural activities were investigated. The site characteristics are briefly given below:

Site I	The site with no human interference.
Site II	Some human interference.
Site III	Interference of human settlements - bathing and washing.
Sites IV - V	Receive a little of run-off from surrounding paddy-fields besides being subject to other human interferences.
Site VI	The Site exclusively receives run-off from the surrounding paddy-fields to which different fertilizers are added.

The sampling of water for physico-chemical and biological analysis was started from April and water samples were collected with the help of Ruttner's water sampler.

Observations:

Temperature: The maximum temperature of 22°C was recorded

for Sites V and VI and the minimum of 6°C for Site I.

pH: The values for pH were always in the alkaline range. The highest value of 10.5 was recorded at Site II against the lowest of 7.7 at Site VI.

Calcium: The highest value of 45 mg / l for calcium was registered for Site VI and the lowest of 3 mg / l at Sites I and II.

Magnesium: The values for Magnesium fluctuated markedly during the various months, the highest of 15.0 mg / l being noted at Site VI and the lowest of 6 mg/l at Site I.

Dissolved oxygen: Dissolved oxygen was highest during low temperature periods and lowest during the high temperature periods. Oxygen concentration was observed to be high during April followed by a consistent decrease thereafter. The maximum values of 19.5 mg / l were observed at sites I and II and minimum of 8.3 mg/l at site VI. The oxygen values were lower at places where the water was in slow motion.

Chloride: Chloride values were mostly higher during low flows, the highest value of 28.0 mg/l being recorded at Sites I and II.

Ammonia: Ammonia showed highest values at Sites IV and VI. The maximum values were 55 mg/l at Site VI and the lowest 1 mg/l at Site I.

Nitrite: Nitrite is generally present in traces. The maximum values (19.9 mg/l) was noted for site VI as against the lowest value (1.5 mg/l) at Site I.

Nitrate: High levels of nitrate were depicted during early summer. Site VI exhibited the maximum value of 220 mg/l and the minimum of 21.3 mg/l during the course of the Solar year.

Phosphate: The values for available phosphate were maximum during summer which started declining towards the autumn months. The highest values of 80 mg/l and the lowest of 30 mg/l were recorded for Sites VI and I respectively.

From the observations, it is clear that maximum of nutrients especially NO_3^- -N, PO_4^- - P, Ca and Mg are characteristic of Sites IV -VI. The high concentration of these nutrients at these Sites is ascribed to the growing cultural activities of human settlements in the catchment including the wash-off from paddy fields that results in their nutrient loading.

TABLE : SOME OF THE PHYSICO-CHEMICAL CHARACTERISTICS
OF VARIOUS STUDY SITES(BASED ON DATA COLLECTION
FOR APRIL 1983 - SEPTEMBER 1983).

Sites	Temp. °C	Parameter					Ammonia mg/l
		pH	dissolved oxygen mg/l	Chloride mg/l	Phosphate mg/l	Nitrate mg/l	
I Min.	6(May)	8.4(Jul)	2.9(July)	4.0(May)	10(Apr.)	30(Sept.)	1.0(Apr.)
Max.	13(Jul)	8.9(Apr)	19.5(Apr)	9.9(Sept.)	30(Jul)	100(Jun)	10(Aug)
II Min.	6(Apr)	8.5(Jun)	2.0(Jul)	3.0(Apr)	8(Apr)	21.3(Sept.)	1.3(Apr)
Max.	11(Jul)	10.5(Jul)	19.5(Apr)	9.0(Sept.)	32(Jul)	110(Jun)	10.8(Sept.)
III Min.	8(Apr)	8.8(Jun)	2.1(Aug)	3.2(May)	10(Apr)	32(Apr)	1.8(Apr)
Max.	21(Jul)	9.1(Apr)	18.2(May)	10.0(Sept)	50(Sept.)	100(Jun)	15.0(Jun)
IV Min.	7.5(Apr)	8.5(Jul)	2.1(Jul)	3.5(Apr)	40(Apr)	48(Sept)	2.0(Apr)
Max.	22(Aug)	9.0(May)	19.7(Apr)	11.2(Sept)	75(Jul)	190(Jun)	50(Jul)
V Min.	8.0(Apr)	8.3(Aug)	1.9(Jul)	2.0(May)	40(May)	30(Sept)	2.0(Apr)
Max.	16(Jul)	8.9(Apr)	18.0(Apr)	13.0(Sept)	60(Jun)	200(Jun)	50(Jul)
VI Min.	8.2(Apr)	7.7(Jul)	0.6(Jul)	7.0(May)	33(Apr)	40(Apr)	5.0(Apr)
Max.	22 (Jul)	8.4(May)	8.3(Apr)	28.0(Sept)	80(Jul)	220(May)	55(Jul)

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The phytoplantation abundance showed a linear relationship with the nutrient concentration, especially the concentration of nitrate - nitrogen. The dominant group throughout the study period was that of Bacillariophyceal characterized by the species of Naricula, Synedra, Fragillaria, Gomphonema, Diatoma, Cymbella, Finularia and Ceratoneis. Cyanophyceae characterize mainly by the species of Microcystis and Gloeocapsa were detected to some measure while chlorophyceaeen forms were very rare. The zooplankton is in the process of identification and similarly the studies on other aspects like Na and K, BOD, productivity and sediment characteristics are under progress, with ultimate aim of working out the stream and lake metabolism.

FAUNISTIC STUDIES

On the basis of biogeographic factors the whole Telbal-Dachigam catchment has been divided into a number of smaller units, viz., Telbal-Botapora, Harwan, Chandapora, Lower Dachigam, Upper Dachigam and Dara. Presently the studies are being undertaken in Lower Dachigam area.

Dachigam, an important National Park, is the home of famous Kashmir Stag - Cervus elaphus hangla. The area is densely stocked by a variety of forest trees, comprising conifers - Pinus and Cedrus, broad leaved deciduous types like Poplars, Oak, Moxus, Salix and a large variety of shrubs. The area has remained largely free from biotic interference and has maintained its floral and faunal identity and diversity of representative endemic types.

During the first phase a complete documentation of animals, their population and community structure is being carried out. Presently the following investigations are in progress.

1. Soil Fauna: The soil fauna while maintaining a definite soil structure and enhancing the soil fertility plays a great role in the functioning of the eco-system. Soil fauna is being collected for the study of qualitative and

quantitative composition, population size, patterns of distribution and its relation to various abiotic factors. On the basis of various physical and biological features, collections are being made from six stations twice a week. The samples collected are carried to the laboratory for biological analysis. The following forms have so far been identified:

Scolopendrilla, Bembidiox sp., Formica sp.,
Gyrotalpid nymphs, Dipteran nymphs, Mites - Haplochthonius
Cosnethonus, Allothrus, Oribatula, Collumbolla -
Felsomia, Hypoqastrura, Brachystomella,
Mematodes - Heterodella, Helicohytenchm

A large part of the collection is being identified and samples have been sent to Z.S.I. Permanent preparations of large number of specimens have been prepared for purposes of identification and other studies.

Stream bioces : There are a number of small to medium sized streams of which Dachigam Nallah is most important. The nallah is well protected and is used for raising trout at Laribal trout farm. During the present investigations, it is being surveyed for various organisms with some bearing on fish populations. The following populations have already been identified.

Caddis fly larvae, May fly naiads, Beetles -adults,
Beetle larvae, Notonectides, Water scorpions,
Snails and Gammarides

Avifauna: The Thick forests of lower Dachigam provide a cover and nesting sites for a large number of birds of which the following have been sighted:

1. Asiatic Cuckoo - Cuculus canorus telephonus (Heine)
2. Common Myna - Acridotheres tristis tristis (Linnaeus)
3. Himalayan Starling - Sturnus vulgaris himii (Brooks)
4. Hodgsons Rosa Finch - Carpodacus erythrurus roseatus
(Blyth)
5. Indian oriole - Oriolus oriolus kundoo (Sykes)
6. Tickell's willow warbler - Phylloscopus affinis (Tickell)
7. Western Yellow - Urocissa flavirostris
billed blue Magpie cucullata (Gould)
8. Himalayan Black bulbul - Microscelis psaroides
psaroides (Vigors)
9. Long tailed Minivert - Pericrocotus ethologus
10. Eastern Grey Wagtail - Motacilla cinerea melanope (Pallas)
11. Kashmir Grey tit - Parus major caschmirensis (Hortert)
12. Tickell's Thrush - Turdus unicolor (Tickell)
13. Hume's Blue Rock Rigeon - Columba livia neglecta (Hume)
14. Large crowned willow warbler - Phylloscopus occipitalis
occipitalis (Blyth)
15. Central Asian Kingfisher - Alcedo atthis pallasii
(Reichenbach)

16. Kashmir Red Breasted Flycatcher - Siphia hyperythra
(Cabanis)
17. Kashmir Redstart - Phoenicurus ochruros phoenicuroides
(Horsfield and Moore)
18. Himalayan Rufous Turtle Dove - Streptopelia orientalis
meena (Sykes)
19. Rufous backed shrike - Lanius schach erythronotus (Vigors)
20. Himalayan Paradise Flycatcher - Terpsiphone paradisi
leucogaster (Swainson)
21. White browed Blue flycatcher - Muscicapula
superciliaris superciliaris (Jerdon)
22. Indian Short billed Minivert - Pericrocotus breirostris
brevirostris (Vigors)
23. Indian Grey Drongo - Dicrurus leucophaeus longicaudatus
(Jerdon)
24. Pale bush warbler - Homachlamys pallidus pallidus
(Brooks)
25. Himalayan Gold finch - Carduelis caniceps caniceps
(Vigors)
26. Hodgson's Field Wagtail - Motacilla alba alboides (
(Hodgson)
27. Gold fronted finch - Metoponias puilla (Pallas)
28. Hodgson's yellow headed wagtail - Motacilla citreola
calcarata (Hodgson)
29. Kashmir Pied woodpecker - Dryobates himalayensis
labescens (Stuart Baker)
30. Brown fronted pied Woodpecker - Dryobates brunfrons
(Gould)
31. Indian Barn owl - Tyto alba stertens (Hartert)
32. Spotted Dove - Streptopelia sp.
33. Crossbeak

Some aquatic winter migrants were sighted in "Harwan Water Reservoir." The birds identified were:

34. Shoveller - Anas Clypeata
35. Wigeon - Anas penelope 36. Tafted Pochard - Aythia fuligula,
37. Common teal - Anas crecca, 38. Garganey - Anas querquedula,
39. Pin tail - Anas acuta,
40. Mallard Anas platyrhynchos.

Since Dachigam is the only protected home of the Hangul deer, investigations are being carried out on its feeding habits. In addition, the park also harbours Black bears, Jackals, Langur. As a part of investigations, pellet and scat analysis is being carried out. The pellet analysis has shown the following plants to constitute the distary items of hangul.

Hedera nepaleusis, Rosa Webbiana, Rosa macrophylla,
Prunus sp., Jasminum humile, Fraxinus sp.,
Berberis lycium, Arthraxon sp., Clematis sp.,
Perratis lacquemontiana, Anthriscus sp.,
Artemisia sp., Rubus ulmifolius, Salix sp.,
Morus alba, Jasminum sp., Celtis australis.

In addition to pellet analysis seats of Himalayan Black bear were also analysed. Seat showed the following

items.

Honey, Apis sp., Morus alba, Prunus sp.,
Berberis sp., Juglans sp., and Celtis australis.

The following areas are proposed to be taken up
next.

1. Fishery status of the streams.
2. Entomsfauna of forest fields and orchards.

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ANIMAL HUSBANDRY

Telbal-Dachigam catchment, for the present study is divided into a number of units including upper Dachigam, Lower Dachigam, Dara, Darbagh, Muthbagh, Harwan, Chandpora, Shalimar, Telbal-Batapora, Chhatrahama, Danihama, Burzhama and Wanihama.

Sheep and goats constitute chief source of protein for the entire population of the area, cows as the only source of milk and bulls for agriculture, mechanical farming being practically not in use in this area.

Proper management of pastures and fodder, and measures to control the diseases of the livestock is found essential for their development and growth. Large number of pathogenic parasites have been found harbouring the live stock in this area and known elsewhere in the state, and some of these are responsible for high rate of mortality of the hosts, decreased yield of wool, meat and milk. For increased yield development of live stock and their upgrading in relation to nutritive grass and fodder is essential. Pastures and water bodies are the breeding grounds of infective stages of large number of pathogenic parasites of the live stock. In view of this, coordinated study of the problem with the aim of the development of live stock, their food and disease-free surroundings is found essential.

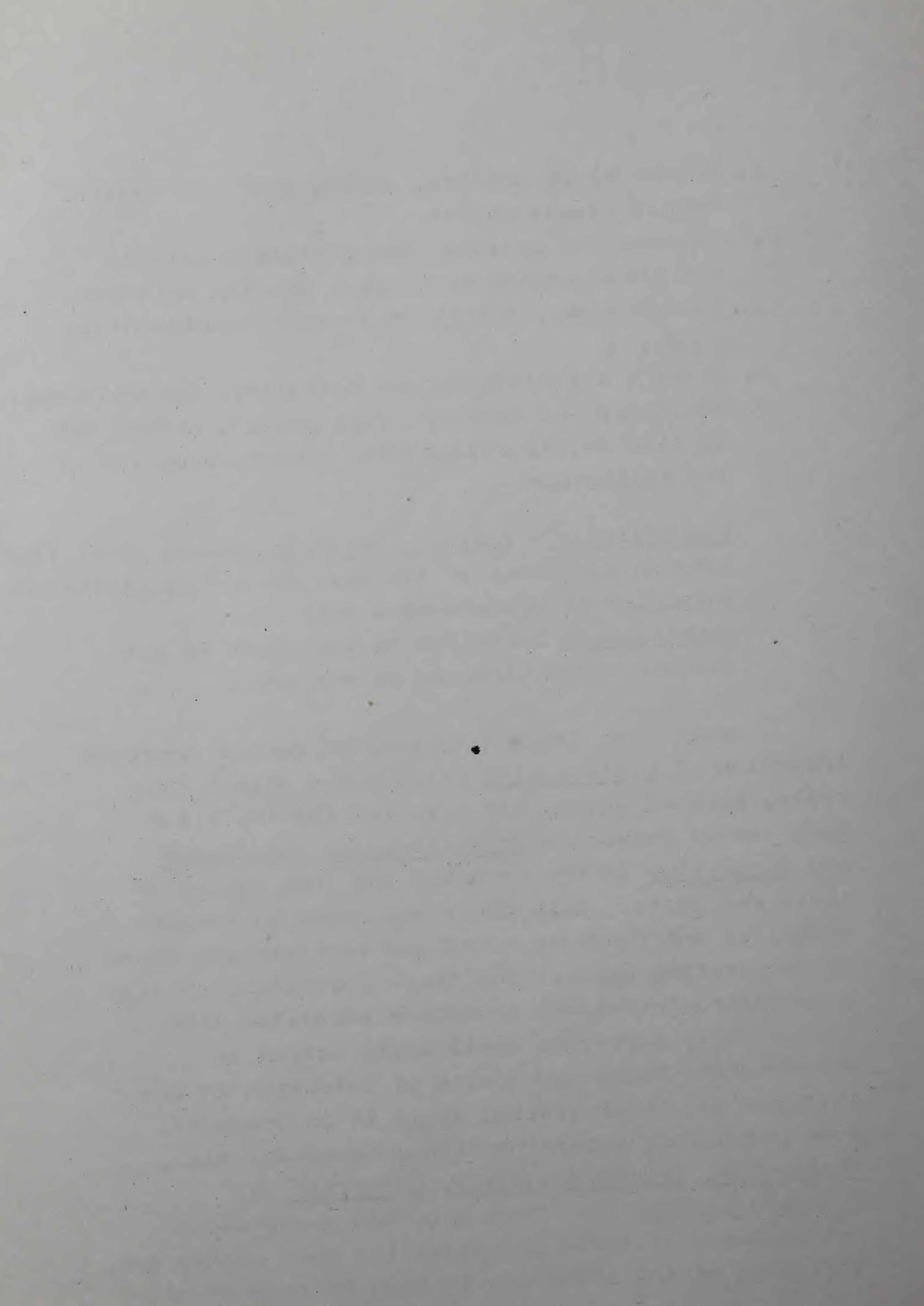
During the first phase, survey in respect of most of the following has been carried out:-

1. Inventory of poultry, sheep, goat and cattle; number livestock/ha"
2. Pastures and grazing lands, grazing animals and their associated fauna; grazing patterns.
3. Fodder types, nutrition levels; supplementary foods.
4. Disease relationship and mortality; epidemiology.
5. Parasites and disease: This aspect, worked out in some detail reveal wide spread infection of the following: -

Fascioliasis - Fasciola hepatica-common liver fluke data on incidence of the disease and intensity of infection is being worked out.

Dicrocoelium infection in the liver is yet another common disease in the area.

Among lung infection, besides common nematode infection of Dictyocaulus which has a direct life cycle, present survey has revealed for the first time severe infection Protostrongylus Cytocaulus and Muellerius in the bronchii and lung tissue of sheep and goats. Both these are known to involve snails as intermediate hosts and carriers and found in the grazing areas. For these parasites, as also some gastro-intestinal trematode parasites like amphistomes, survey of snail hosts acting as intermediate hosts and source of infection in the pastures and other grazing areas is in progress. Some pathogenic gastrointestinal nematodes viz., Haemonchus, Trichostrongylus, Chabertia and Oesophagostomum have been recorded among sheep. Pathogenicity of these parasites has been worked out. Incidence of the infection is high in respect of



Chabertia, Oesophagostomum and Haemonchus. Mode of infection under local condition is being worked out. Survey of some of the foot-hill pastures has revealed the presence of land snails. The snails identified are Succinea putris, Lymnaea truncata, Physa acuta and Cionella lubrica. Infective stage of Muellerius were detected in July in the foot of some of the snail specimens of Succinea. Detailed study of the parasites is in progress, with the aim of finding suitable methods of the use of larvae for immunising the sheep. In the next phase, experimental infection of sheep and use of larvae and infected lung tissue for the study of immunising or as vaccine will be taken up. Since various snails as intermediate hosts of the lung nematodes and trematode parasites of cattle and sheep have been detected, it is found essential to make use of preventive measures for the control of various disease by finding suitable use of molluscicides. It is proposed to undertake detailed study of the use of Dinitrophenols (Dinitro-o-cyclohexylphenol and its dicyclohexylamine salt-K604) which are known to be useful against molluscs in field, acting as intermediate hosts of Schistosomes.

Hydatid disease among sheep and goats has been revealed to be quite high. Infection is mostly found in liver and in some case in spleen and abdominal cavity. This infection among herbivores is because of their close association with dogs and carnivores which harbour the adult cestode (Echinococcus). This has a direct relationship with the increasing prevalence of highly pathogenic hydated disease among local human population. Isolating carnivores from the grazing areas of sheep and cattle is the only way to keep off infection of hydatids. This is also true of keeping away carnivores

from slaughter houses.

Schistosomes (Orientobilharzia) blood fluke has also been identified in local sheep of the area. Survey has revealed that Planorbis species in the area is acting intermediate host of the species. Further study is found essential to find suitable measure to control the infection.

AGRO-HORTICULTURE

Telbal Dachigam catchment has a rich agro-horticulture complex, development of which is of prime importance. The units included in the catchment for the present study are Wanihama, Burzhama, Telbal, Batpora, Chatrahama, Danihama, Darabagh, Muthbagh, Dara, Harwan, Chandpora and Shalimar. The agricultural crops in the area are rice, wheat and maize (mainly rice); pulses (sarson); horticultural crops include apple, pear, plum, peach, cherry, walnut and isolated apricot, walnut and almond plantation. In some areas like Wanihama, Darabagh, Harwan, Chandpora and Shalimar, there are several farms for seed production, mostly those of cabbage, cauliflower, chillies, knol-khol, bringjel, tomato and beans, as also some flower seeds and bulbs.

During the first phase, present investigation has revealed the prevalence of insect and nematode pests in vegetable fruit and some food crops which affect their production and quality. Proper management and control of above-ground and under-ground insect and nematode pests is, therefore, found essential. Some of the pests detected during the present survey are as under:-

1. Lymantria obuscata (Gypsy moth-Elepidoptera)- wide spread on willow and popular trees and occasionally on apple, plum, apricot and walnut trees in the area, causing extensive damage to the foliage.
2. Phytomyza horticola (Diptera) infesting cruciferous plants - sarson, hak and knol-khol. Heavy infestation was detected in Telbal region, Darabagh and Chandpora units of the area.

3. Plutella maculipennis (Lepidoptera) are found infesting the above mentioned cruciferous vegetable crops. It is also a foliage pest.
4. Erisoma lanigerum (Wooly apple aphid (Homoptera) found infesting apple stem, its branches and foliage. Heavy infection was detected in some nurseries.
5. Brachy caudus helicrysi (Homoptera)
6. Mylopterus pruni found infesting plum, peach and almond trees.
7. Brevicoryne brassicae (Homoptera) found infesting vegetable crops-Hak and Cabbage.
8. Lipaphis erysimi (Homoptera) found infesting mustard planation.
9. Aphis pomi (Homoptera) found infesting apple trees.
10. Mytillocerus sp. (Coleoptera) found infesting wide variety of fruit crops - apple, pear, plum, peach, cherry and walnut, causing defoliation. This weevil is causing wide destruction of leaves and young shoots, resulting substantial loss to horticulture.
11. Myzus persica (Homoptera) found infesting cereal crops in Wanihama and Darabagh area.
12. Laspeyresia pomonella (Lepidoptera) found widely infesting apple fruits in the area. Damage is caused by larvae, hatched out of eggs which are earlier laid by the females in the flowers. Damaged fruits are also attacked by fungi also.
13. Denodorix epijarbas (Lepidoptera) found infesting pomegranate fruits. Damage to the fruits is by the larvae.
14. Pieris brassicae (Lepidoptera) infesting cruciferous crops. Eggs are laid on leaves and the larvae hatched feed on them. Dipteran larvae were also found feeding on damaged material.

15. Panaphis jugulandis (Homoptera) was found infesting most of the walnut trees, causing damage to leaves. Larvae of a dipteran fly, Episyrphus was found to be the predator of these aphids.
16. Diachrysia orchales (Lepidoptera) is found a serious pest of cruciferous plantation, mostly 'hak' in this area, it feeds on the leaves.
17. Lyaneltia sp. (Lepidoptera) It is found infesting apple and cherry. The larvae form linear mines in the leaves of these fruit trees.
18. Eulecanium coryni (Hemiptera) found infesting pear, apple and plum trees.

Present survey has revealed the presence of predators of some of pests in the area. Such parasites are found to be potential tools for the biological control of the pests. The predators identified so far are:

Chrysopa carnea (Neuroptera) as a parasite of Mytillocerus; Brachymeria intermedia (Hymenoptera) as parasite of Lymantria; Dibrachys cavus as a parasite of Myzus and Chilochorus rubidus (Coleoptera) as a parasite of Eulecanium. Further studies are in progress to identify the parasites of other pests. Laboratory study on the biology of these parasites is being carried out to evaluate the feasibility of the use of these predators. Field trials will be taken up in the next phase after detailed study of the parasites.

Priority is being given to the methods of biological control of the pests. This will minimize or even eliminate the use of insecticides.

PHYTONEMATODE PARASITES:

In view of the importance of nematodes as pest of

various crops, survey has been taken up to identify the pathogenic parasites. The parasites detected from soil samples collected from various fruit, vegetable farms and agricultural lands of the region are as follows:-

	<u>PLANT HOSTS</u>	
<u>Anquina</u>	...	Wheat
<u>Helicotylenchus</u>	...	Pear, apple, almond.
<u>Pratylenchus</u>	...	Pear, apple, almond and strawberry
<u>Psilenchus</u>	...	Cherry, Pear, Apple
<u>Xiphinema</u>	Wheat, Rice, Pear, apple.
<u>Tylenchus</u>	...	Apple, pear, almond.
<u>Criconema</u>	...	Tomato, cherry, pear.
<u>Criconemoides</u>	...	Tomato, Beans, Cherry, Pear.

The fruit nurseries were found infested with most of the above mentioned nematodes parasites, causing retarded growth in the plant.

Survey is in progress for the detection of other soil nematodes as parasites of the various economically important plants. Soil samples are also being examined in detail for the detection of nematophagous fungi. One of these Dactyllela, has been isolated. This is being tested in the laboratory against various pathogenic nematode parasites of various plant hosts. Such fungi can be cultivated and released in small vegetable farms for the control of some of the nematode pests, thus eliminating/ minimizing the use of nematicides.

Collection of background data of the area in respect of most of the following has been made.

1. Production of various crops at village level,

per head availability production potential of the area.

2. Productivity profile of each crop: percentage share of each crop to total cropped area, per hect, production.
3. Identification of problems to increased yield level.
4. Cropping patterns, need for innovations.
5. Land forms, land use patterns; cultivable waste lands, encroachment of pastures and forests.

EFFECTS OF PESTICIDES

Pest control concerns every one. It is the day to day business of a wide variety of professional men, including Farmers and Salesmen, Chemists and Biologists, Physicians and Physcists. Pesticides may be consumed by human beings through food chain in variable concentrations depending upon their usage in particular locality. Further, these can be toxic if consumed in enormous rate. The catchment under reference has number of orchards, paddy field, around and lots of fungicides are being used to combat primarily to control plant diseases but indirectly their effects become hazardous for mankind. So ultimate aim of this study is to evaluate the various quantities of the residues from fish found in the Dal lake and the vegetables grown around it which finally are consumed by man.

Since no detailed studies on the toxicity of such products have so far been carried out from this part of the country, the present studies were taken up under the Eco-development Project and restricted to Telbal-Dachigam catchment area, so as to note the effect of pesticides including both fungicides and herbicides on the non-target organism. Also some bioassay methods have been standardised to moniter the residues of various fungicides from different parts parts of the plant.

A number of studies have been carried out during March-September this year and are to be repeated during the subsequent years for knowing the effect of pesticides (fungicides and herbicides) on the nontarget organisms area:

1. Effect of Pesticides on Non-target organisms (Microbes).

The microbes present in the soil have an eminent role in the field of biology. These microbial organisms are the primary producers in a well balanced ecosystem because of their ability to degrade the biological products and make them available to the growing plants, thereby reaching MAN the ultimate consumer of this plant through food chain.

The use of pesticides have affected these micro organisms tremendously because of the fact that in a pesticide application only 1% of this reaches the target organisms as reported earlier by Gupta and Gupta (1977), while the rest is drifted into the "nonliving environment" and finally into the soil which restores all the complex substances.

In this study the soil samples are collected every month from orchards, adjoining Telbal-Dachigam catchment area, which are treated with Dithane M 45 (2500 ppm) and Bavistin (500 ppm) the most commonly used fungicides in our

orchards and their effect monitored by soil dilution techniques (the soil dilutions taken are 1%, .1%, .01%). The effect of these fungicides is monitored by directly counting the microbial colonies both bacterial and fungal, on PDA (Potato Dextrose Agar) and RBA (Rose Bengal Agar) medium respectively and later these are compared with control. The studies revealed that DM 45 completely inhibited the microbial population whereas, Bavistin enhanced microbial activity when compared to untreated ones.

Similarly from the paddy fields, the soil is collected, dried and sieved. Finally studied by soil dilution technique, the herbicides selected are saturn and Machete. Saturn (750 grams/kanal) and Machets (1.5 kg/kanal) both showed more bacterial growth and less fungal growth.

In addition to these, methods for monitoring the microbial activity in the soil in response to fungicides have been standardised by studying the enzyme activity (dehydrogenase) in the soil and this type of study will be carried out during the coming year so as to know the indirect effect of the fungicide on the microbial activity in the soil.

2. Effect of pesticides on non-target organisms (Plants).

It is a common practice in our orchards to have a

under-crops of some vegetables. The common under-crops are Cucurbits and Legumes. Cucurbits only serve as a vegetable crop whereas, Legumes have an additional property of being able to fix the free atmospheric nitrogen for the growing plants. But, from our valley there is no scientific literature available on the effect of the fungicides on these non-target plants which unnecessarily get hit by the ruthless use of fungicides in our orchards.

Three experiments were designed and carried out to know the effect of these fungicides on such plants.

i) Effect on the germination of Seeds: In order to know the role of these fungicides on the germination of the seeds of these cover crops, and experiment was carried out in laboratory this year (and is to be extended to field during coming years) Various fungicides tried were DM 45 (1500, 2500 and 3500 ppm), hexacap, (750, 1500 and 3000) ppm, Topsin (250, 500 and 750 ppm), Saprol (625, 1250 and 2500 ppm) and Ankur (250, 500 and 750 ppm).

ii) Effect on the growth of plants: This experiment was laid in the orchard to know the effect of some fungicides viz. Bavistin and DM 45 in combination with Bavistin on the seed germination, root and shoot elongation.

The seeds were sown a day before and a day after spray

and finally different parameters were noted at different time intervals.

It was found that there lies a close co-relation between the usage of fungicide and the plant growth. The detailed plans for the coming years have been framed so as to recommend the seed sowing time while the orchardist are on for sprays. The plants with Bavistin treatment had more root and shoot length while those sprayed with DM 45 + Bavistin showed less growth compared even with those of control ones.

iii) Effect on the nodulation: Needless to mention the importance of nodules (borne on the roots of legumes) for the growing plants the present studies were carried out to know the harmful effect, if any, on their formation by the application of different fungicides.

Seeds of pea, beans, clover and berseem were sown in the pots containing orchard soil and treated with different concentrations of DM 45 (1500, 2500 and 3500 ppm) and Bavistin (250, 500 and 750 ppm) and grown under natural conditions and finally their effect on the nodule formation and also the fresh and dry weight of the plants calculated and finally compared with the control.

It was found that generally Bavistin treated plants

were favoured compared even with untreated ones whileas, DM 45 at higher concentration proved to be toxic. Detailed studies are in progress.

In addition some experiments were laid to standardize the techniques to monitor the residues of the commonly used fungicides from different parts of the plant.

In this direction an important experiment carried out this year was to study the translocation of fungicides within the plants.

The bean seedlings (previously germinated under natural environmental conditions) were treated the Bavistin (250, 500 and 750 ppm concentrations), kept in solution with the roots completely away from the light. The seedlings were taken out at an interval of 24, 48 and 92 hours. The plant parts were analysed separately by making their extracts with suitable extracting solvents and later studied by Bio-assay techniques. This type of study was found to be fruitful, especially for qualitative detection of the residue of different pesticides so that these could be monitored from different parts of the plants. For quantitative detection of these residues different chromatographic techniques will be applied in the coming years.

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